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# The natESM sprint concept: a tool for advancing ESM software

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In Earth System modelling (ESM), the high variety and complexity of ESM processes to be simulated as well as the specialisation of scientists led to the existence of a multitude of models, each aiming on the simulation of different aspects of the system. This scenario gave rise to a highly diverse ecosystem of ESM software, whose components are written in different languages, employ different HPC techniques and tools, and overlap or lack functionalities.

To use the national technical resources and the scientific expertise more efficiently, the natESM project aims to establish a coupled seamless ESM system by providing so-called technical-support sprints. A sprint consists of a goal-oriented package of work executed by a dedicated research software engineer on a selected ESM model during a defined amount of time.

The scientist's sprint proposals undergo a technical evaluation, which is divided in two steps: The first is a "sprint check", consisting of a low-threshold method for the presentation of a sprint idea. After an open discussion about the technical feasibility and possible adjustments, if the work aligns in general with the natESM strategy, the proposals move to the second phase, with the creation of a full sprint application. This consists of a detailed document which contains the model characteristics and formalises the goals, timeline, and criteria for sprint fulfilment.

Once a scientific approval is also granted, the work on a sprint starts and lasts from a couple of weeks up to six months, depending on the stipulated timeline and objective. The period and timeline can also be adjusted depending on impediments found along the way. The type of work done is inline with natESM goals, and sprints are usually focused on – but not limited to: architecture porting, model coupling and interfacing, modularization, as well as general software engineering improvements. The overarching concept is to efficiently enable the models to progress in the desired direction, and therefore entails identifying the minimum amount of work which will allow the model to take the largest strides towards the community goal. Upon finalisation of a sprint, a public documentation is published, potentially serving as help to other models on addressing similar problems.

The complete process is based on an open and interactive discussion between the model scientists and the research software engineers. It usually takes the form of short regular meetings and chat-based conversations. The underlying reasoning is to minimise the work a scientist has to do to communicate their problems and to receive support.

Based on the positive results observed and feedback from the community, the sprint concept is proving to be a highly effective approach to improving the technical resources of the scientific community. This tool, guided by a comprehensive strategy outlined by scientific requirements, will help the Earth system modelling future goals to be ever closer. Its applicability extends beyond the field of Earth system modelling and may also prove valuable to other research areas seeking to establish a research-software-engineering service and accelerate the results of partnerships between scientists and RSEs.

## Slot length

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